James River Study 2013

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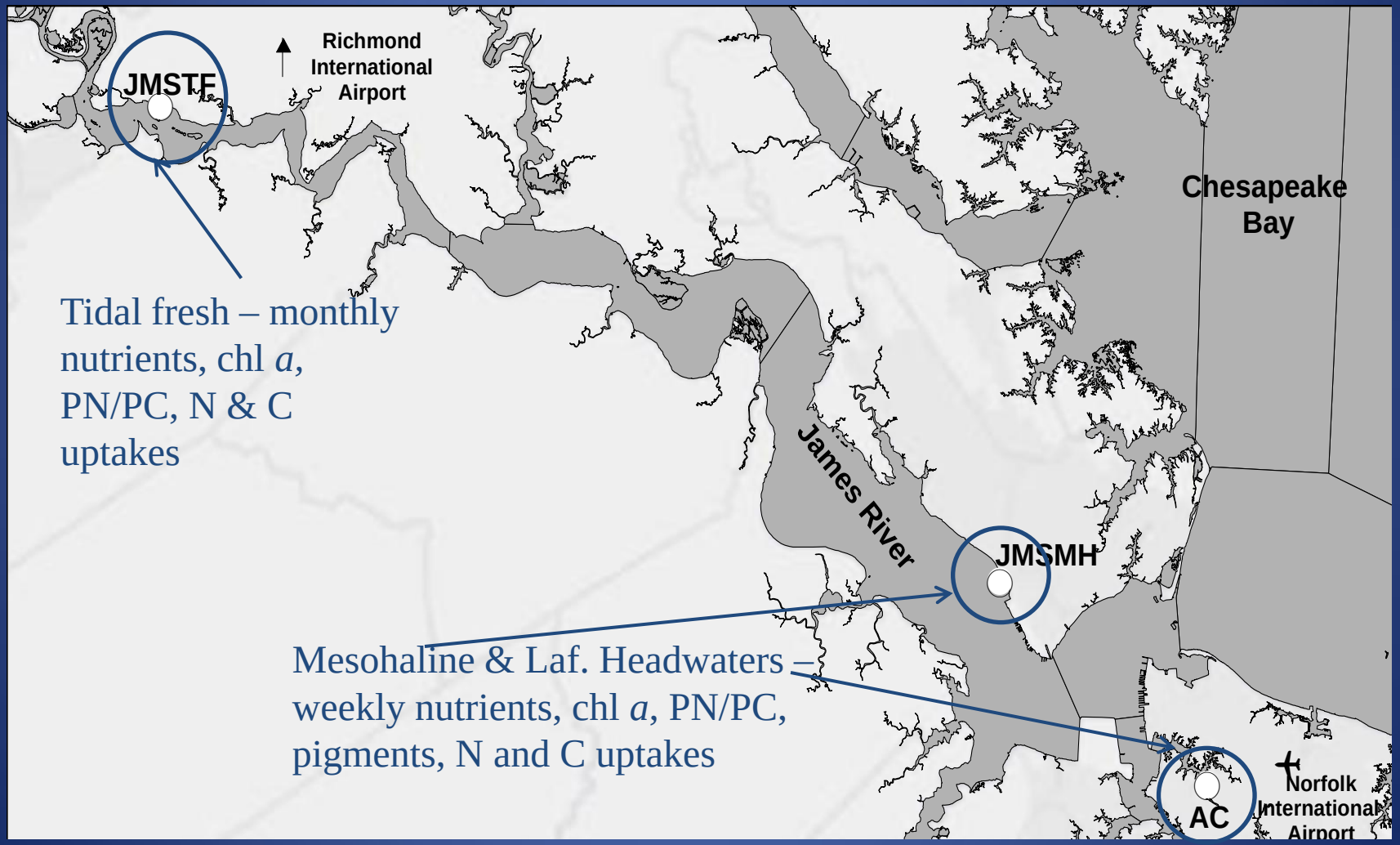
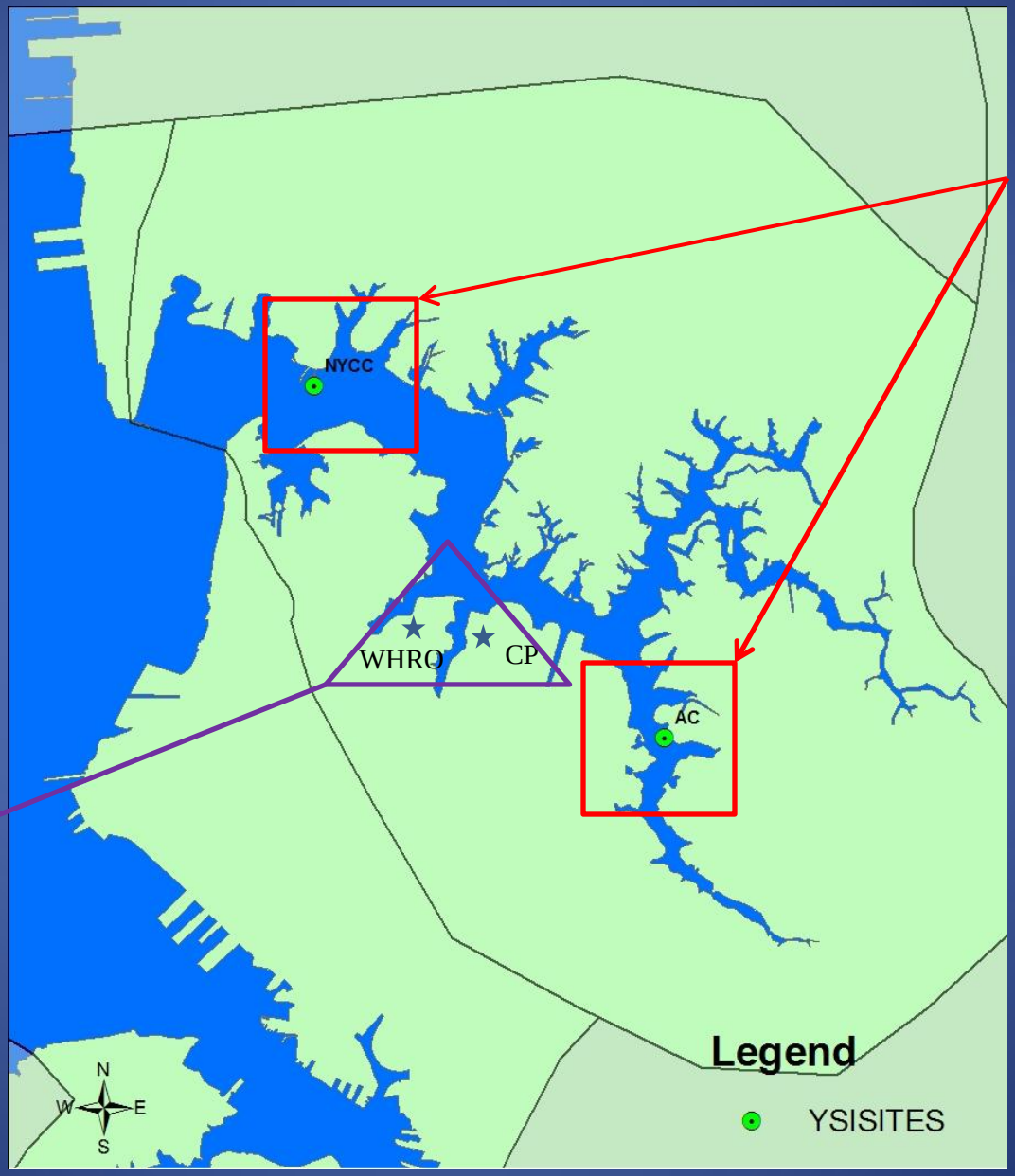
Sampling sites - 2012



Sampling sites – 2012 & 2013

Whole river = nutrient pulsing and DATAFLOW cruises

WHRO and CP = Stormwater sites



NYCC and AC = YSI and Daily sampling sites

Sample inventory - 2012

	Chl a	Nuts	Pigment	PN/PC	DIC	Cell Counts	Uptakes (N & C)	Vertical profiles
JMSTF	5	5	5	5	5	-	5	-
JMSMH	16	16	16	16	16	-	16	-
AC	19	19	19	19	19	-	19	-
Rain event sampling AC	YSI	129	-	-	-	-	-	-
Rain event sampling NYCC	YSI	100	-	-	-	-	-	-
Nutrient pulse cruises	Dataflow	191	-	-	-	-	-	-
Stormwater sampling WHRO	-	8	-	-	-	-	-	-
Stormwater sampling CP	-	5	-	-	-	-	-	-

Sample inventory - 2013

	Chl a	Nuts	Pigment	PN/PC	DIC	Cell Counts	Uptakes (N & C)	Vertical profiles
AC	53	65	53	53	42	53	20	53 (no chl a)
NYCC	50	80	50	50	42	50	16	50 (no chl a)
Rain event sampling AC	YSI	136	-	-	-	-	-	-
Rain event sampling NYCC	YSI	121	-	-	-	-	-	-
Nutrient pulse cruises – Laf. only	Dataflow	190	-	-	-	-	-	59
Stormwater sampling WHRO	-	9	-	-	-	-	-	-
Stormwater sampling CP	-	5	-	-	-	-	-	-

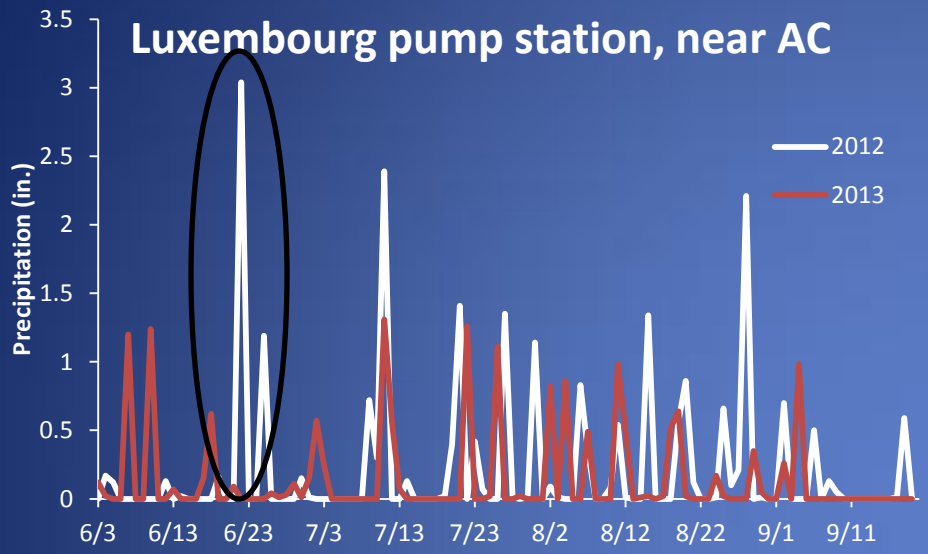
Continuous monitoring (CONMON)

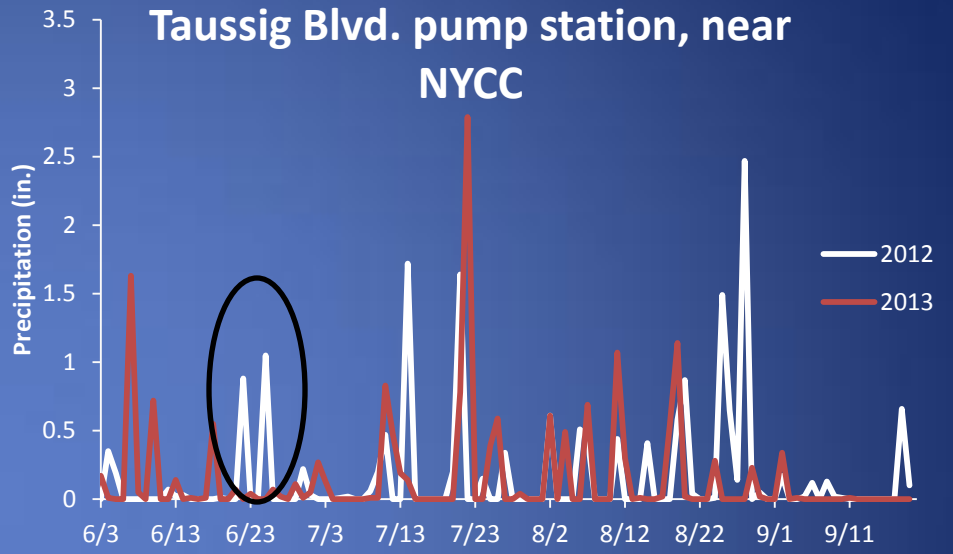
- YSI's at AC (headwaters) and NYCC (mouth)
- Collecting Temp., salinity, depth, fluorescence, pH, turbidity from March – October
- Sites for weekly sampling (AC – 2012) and daily sampling (AC & NYCC – 2013)
- 2 additional sites proposed in James River in 2014 - HRSD

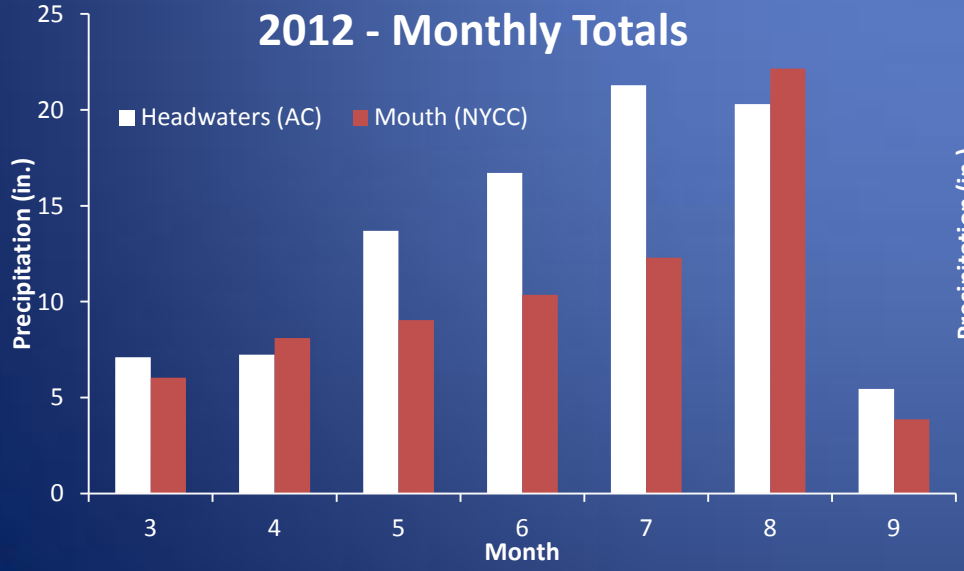
Nutrient pulse studies

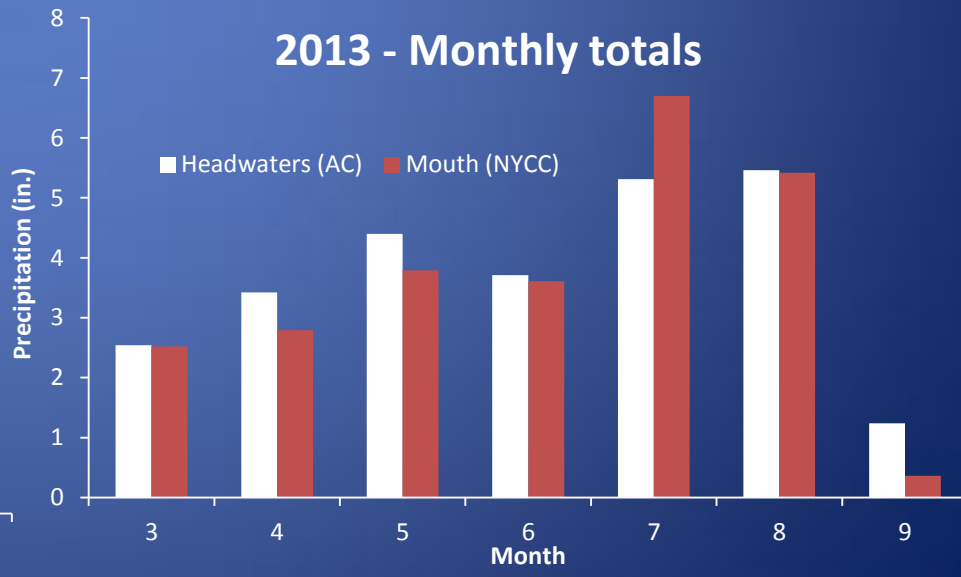
- Combined fixed site monitoring (AC & NYCC) and whole river surface mapping and monitoring before and after rain events
- Nutrients collected 30 minutes and hourly after rain event up to 24 hours at AC & NYCC with ISCOs
- Nutrients collected at 10 surface stations 1 day before and 1 day after rain events along whole river, DATAFLOW in use

Precipitation – 2012 & 2013 comparisons

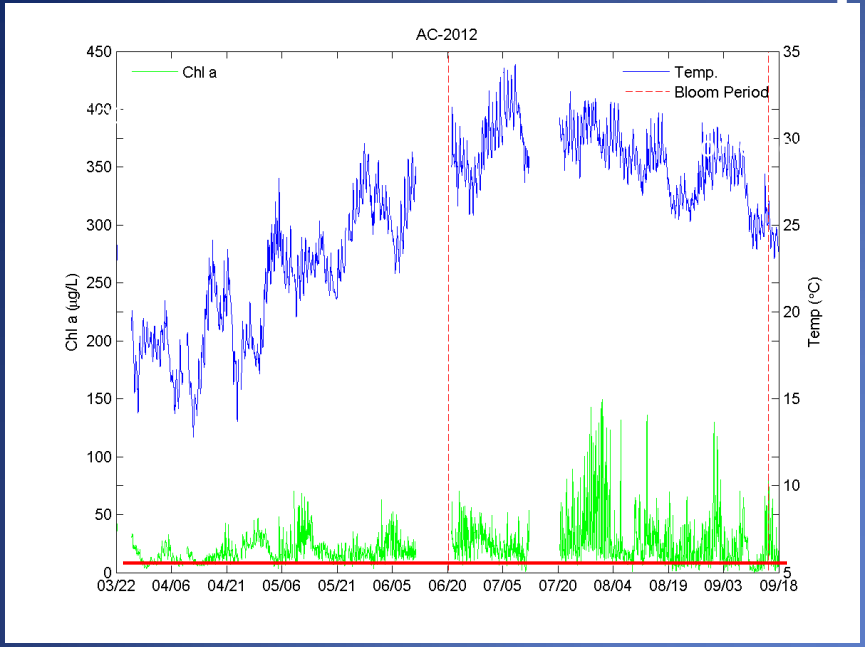


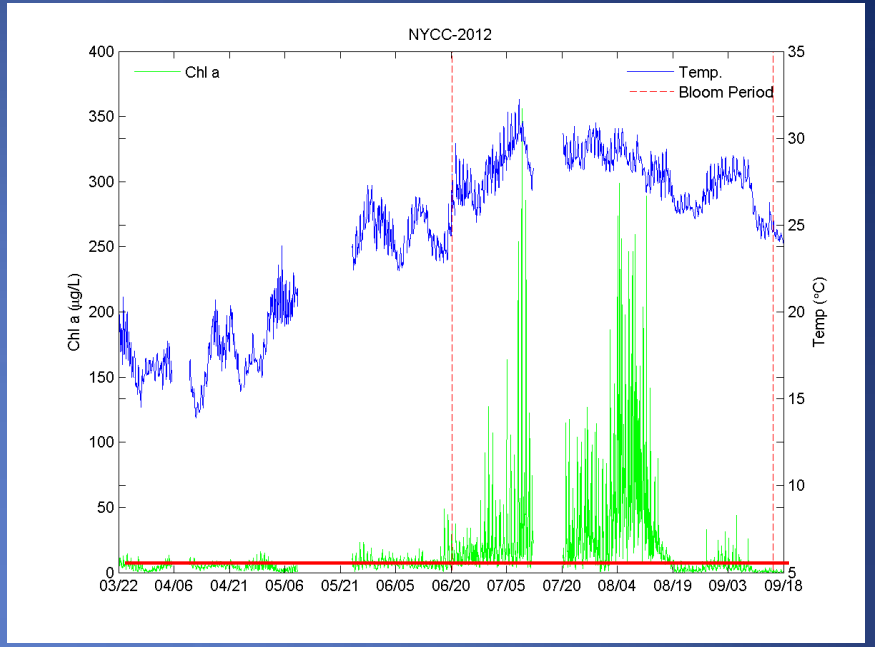


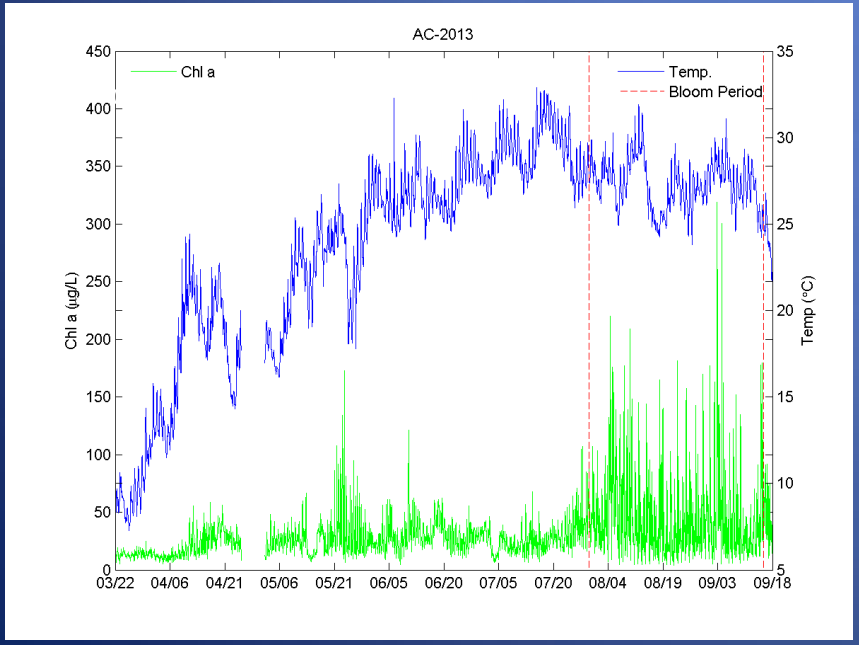


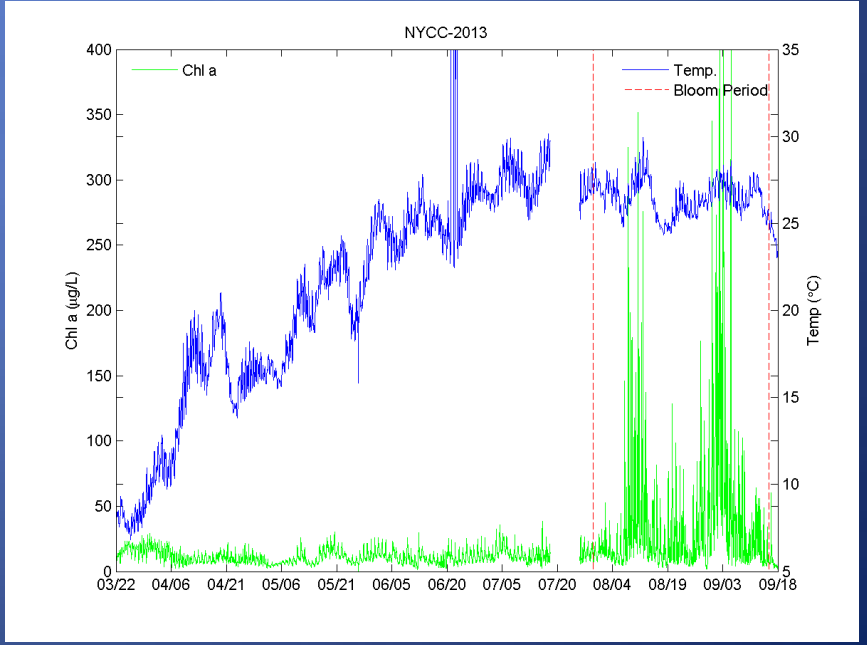


Chl *a* & Temp - 2012 & 2013

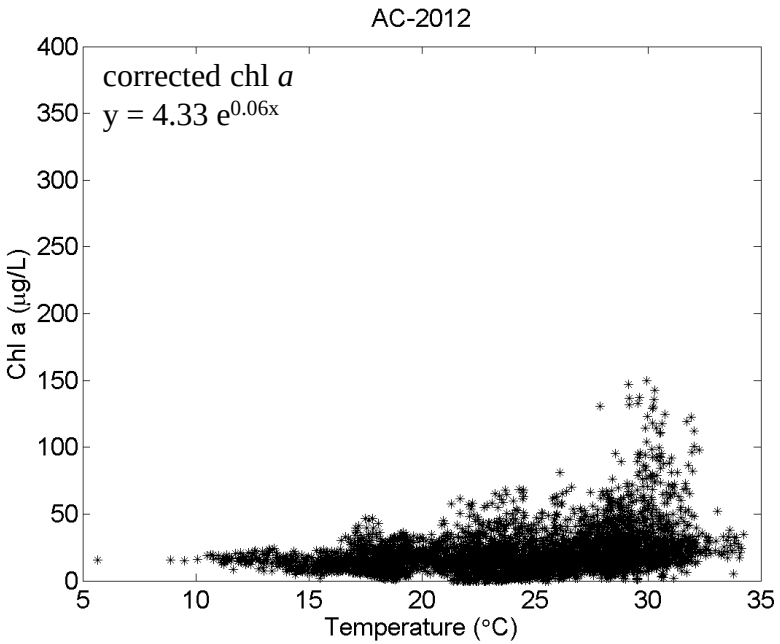


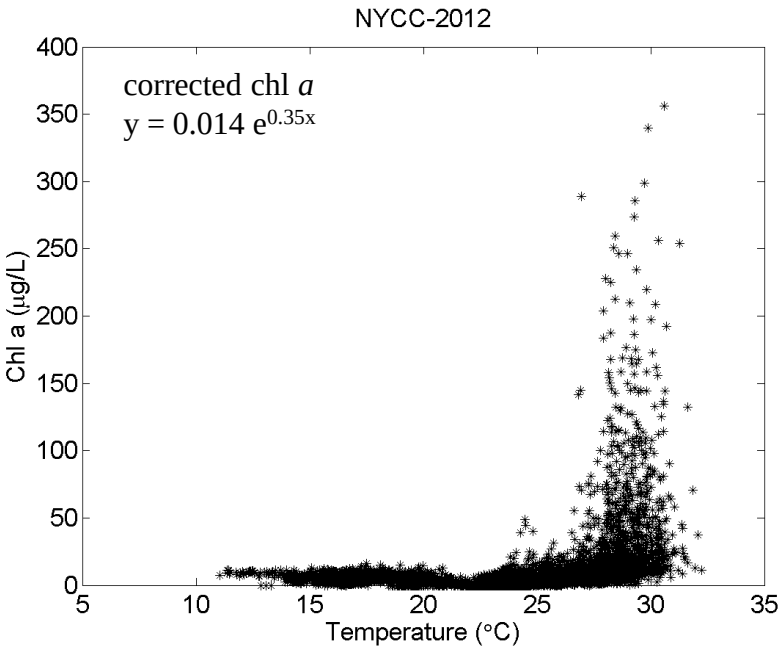


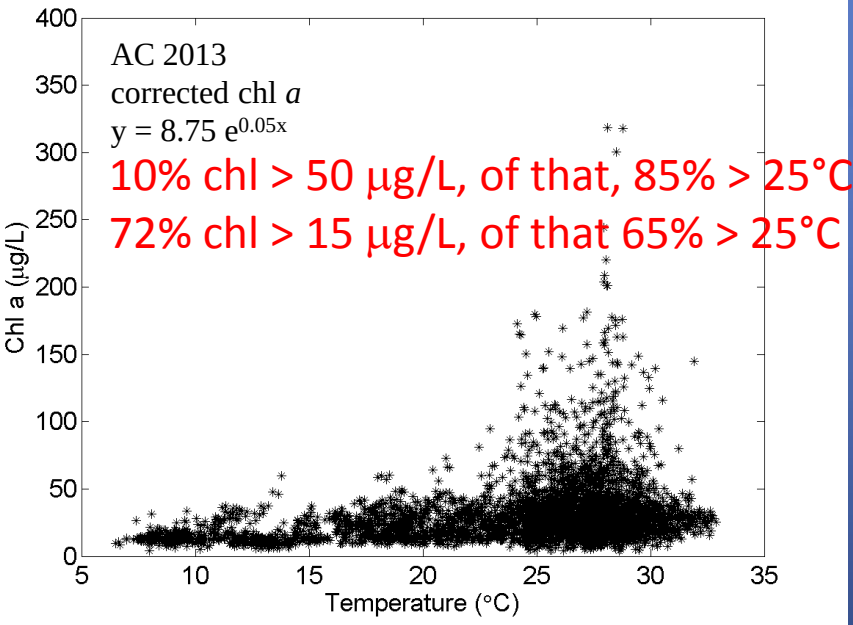


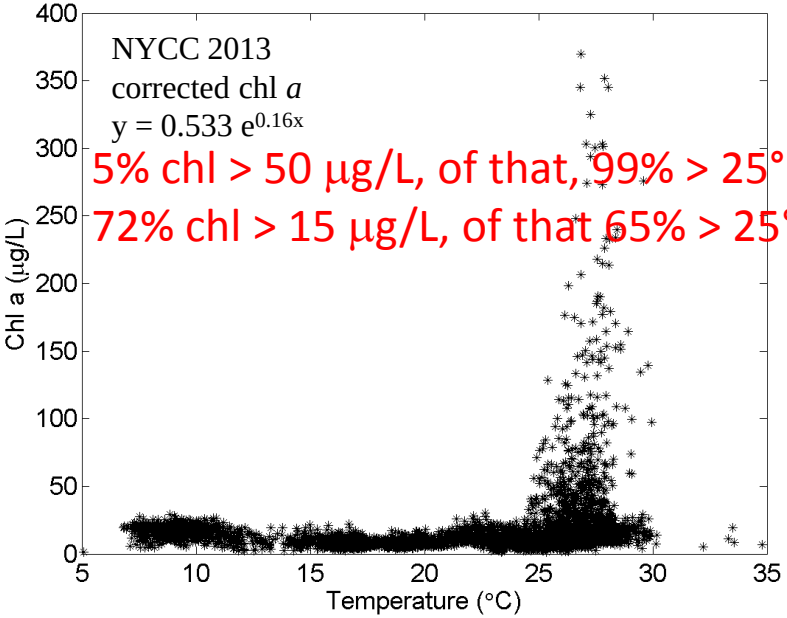


Chl *a* vs temp.– 2012 & 2013

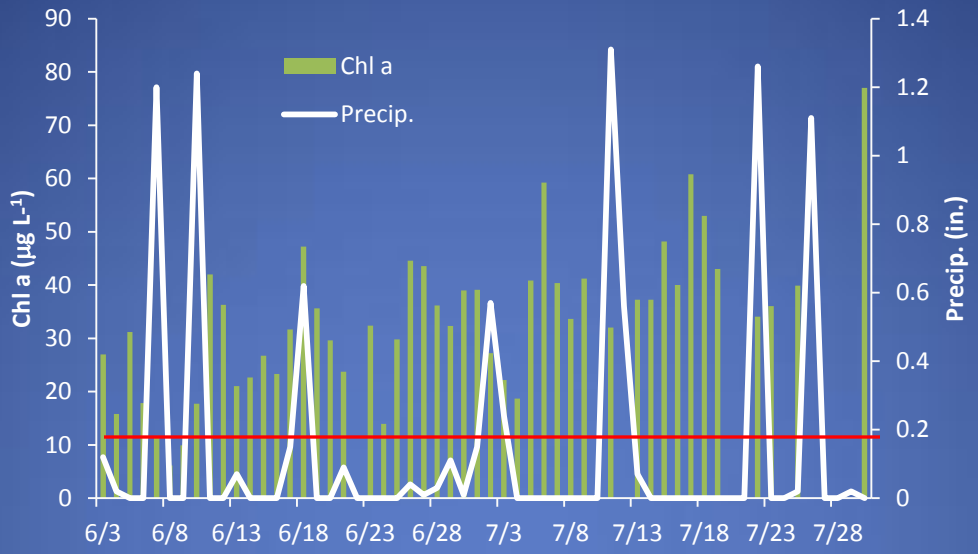


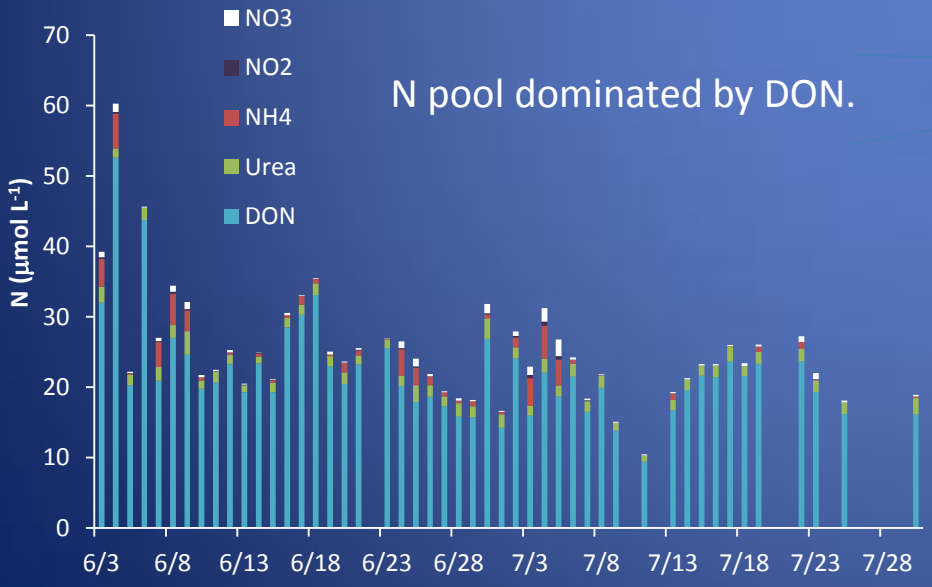






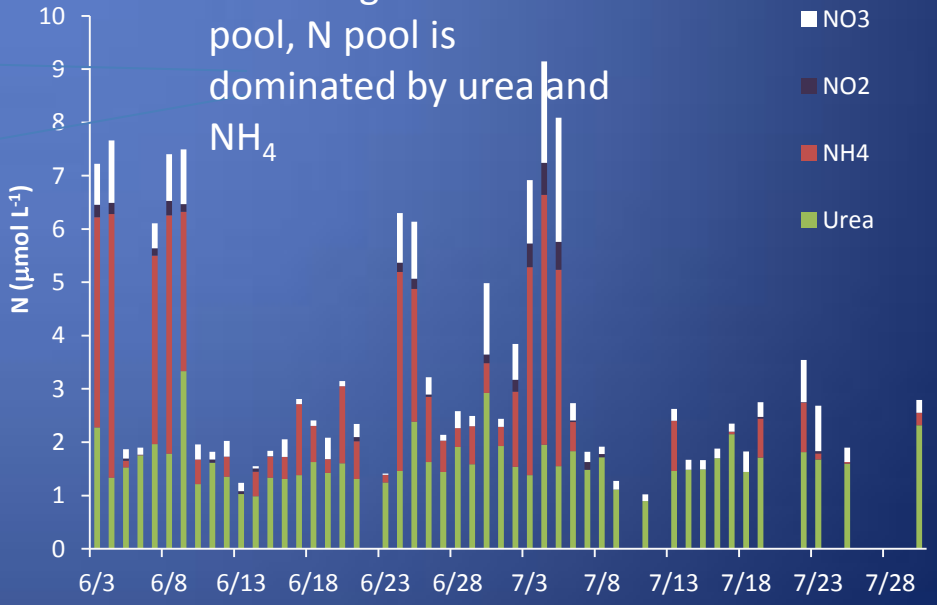
AC – Daily sampling 2013





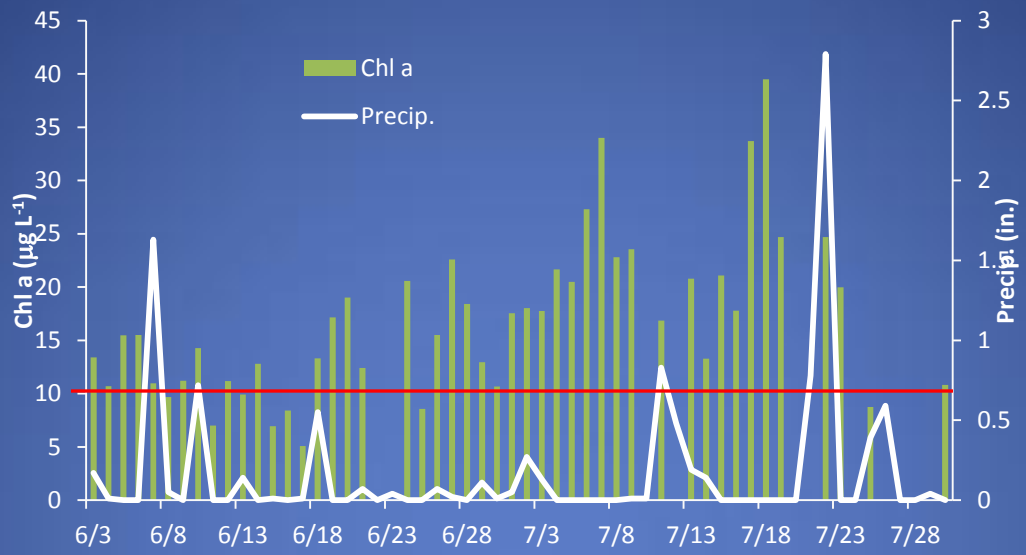
N pool dominated by DON.

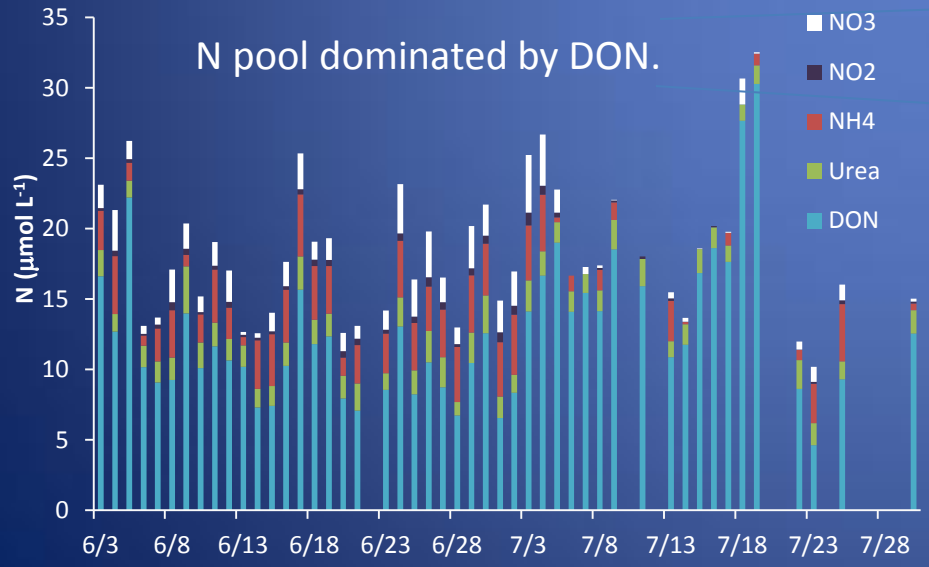
Removing the DON pool, N pool is dominated by urea and NH_4

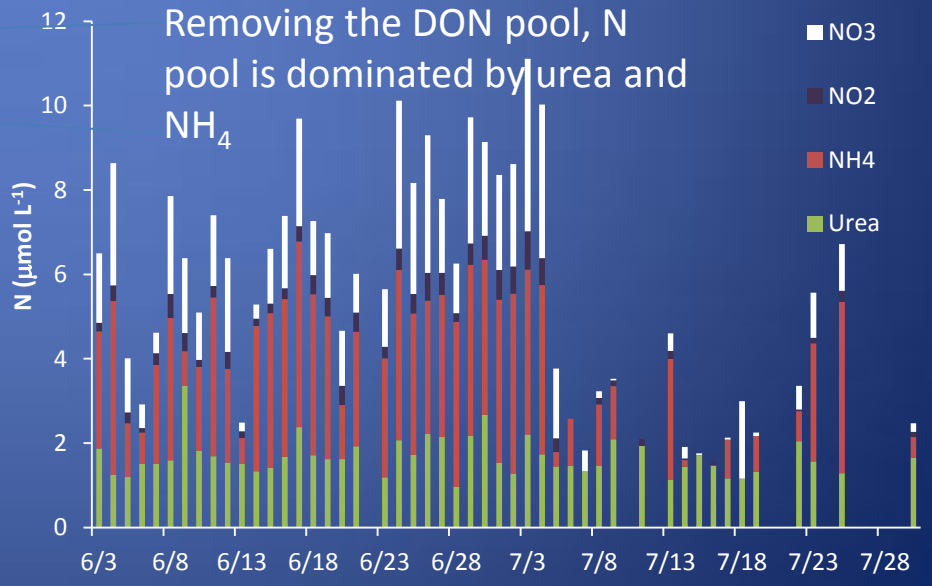


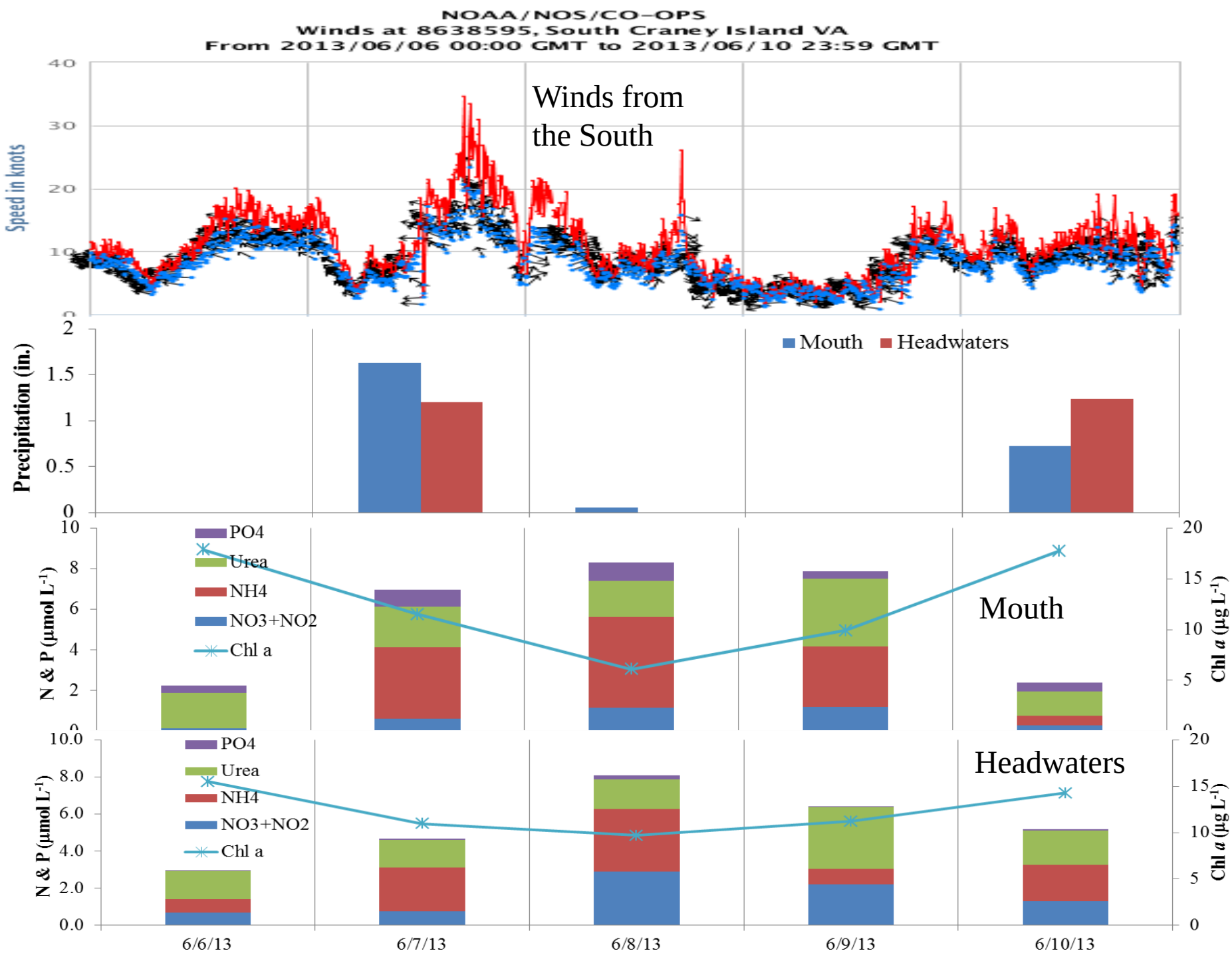
* not corrected chl a

NYCC – Daily sampling – 2013



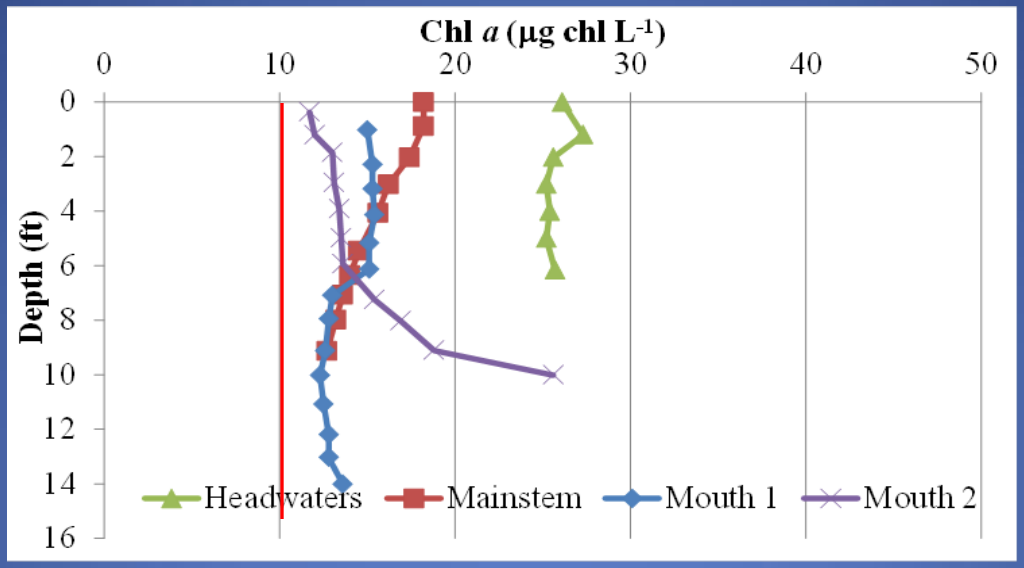




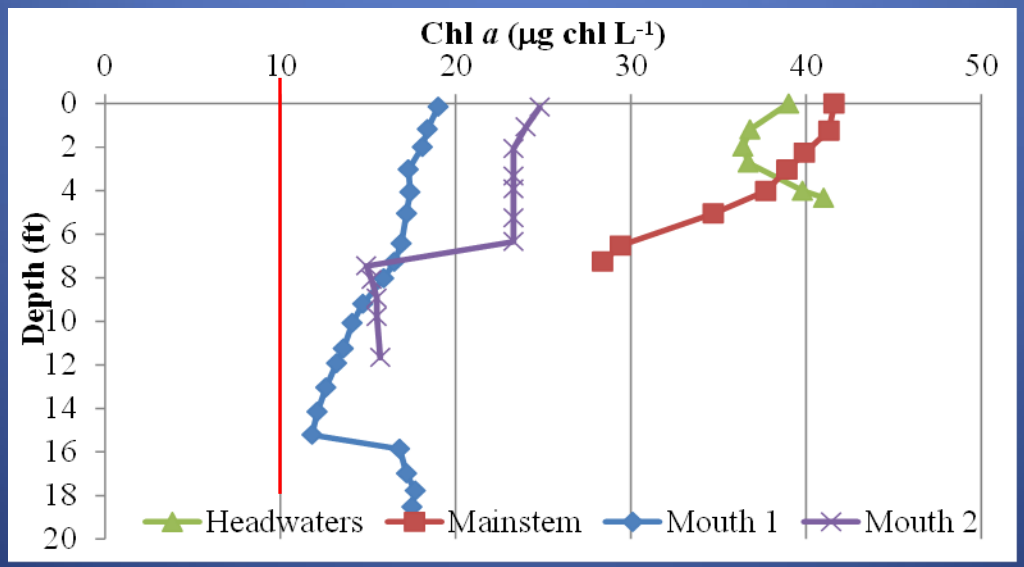

NOAA/NOS/CO-OPS
Winds at 8638595, South Craney Island VA
From 2013/06/06 00:00 GMT to 2013/06/10 23:59 GMT
Speed in knots
Winds from the South
Precipitation (in.)
Mouth
Headwaters
N & P (µmol L-1)
Chl a (µg L-1)
PO4
Urea
NH4
NO3+NO2
Chl a
Mouth
Headwaters
6/6/13
6/7/13
6/8/13
6/9/13
6/10/13

Vertical profiles – storm event

Before storm 6/6/13 (1100 – 1220) – well mixed water column

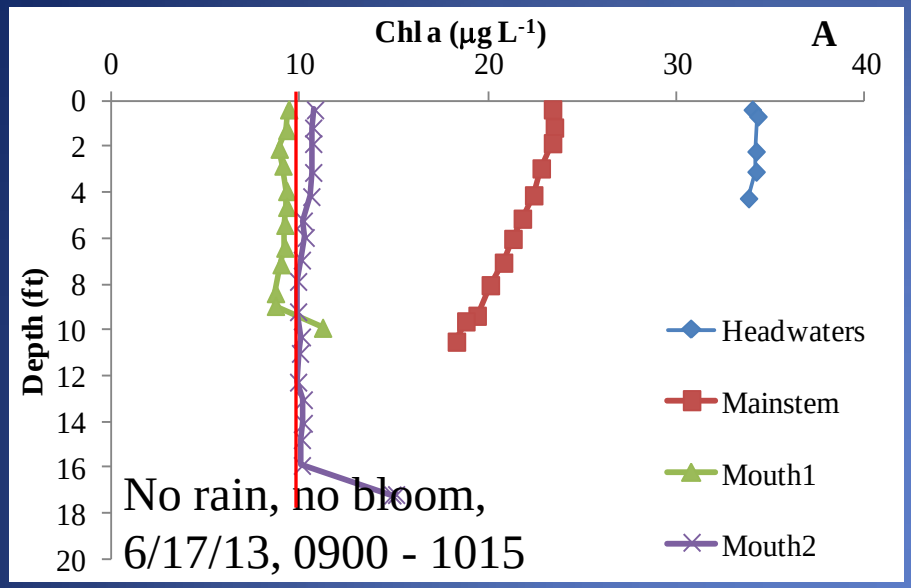


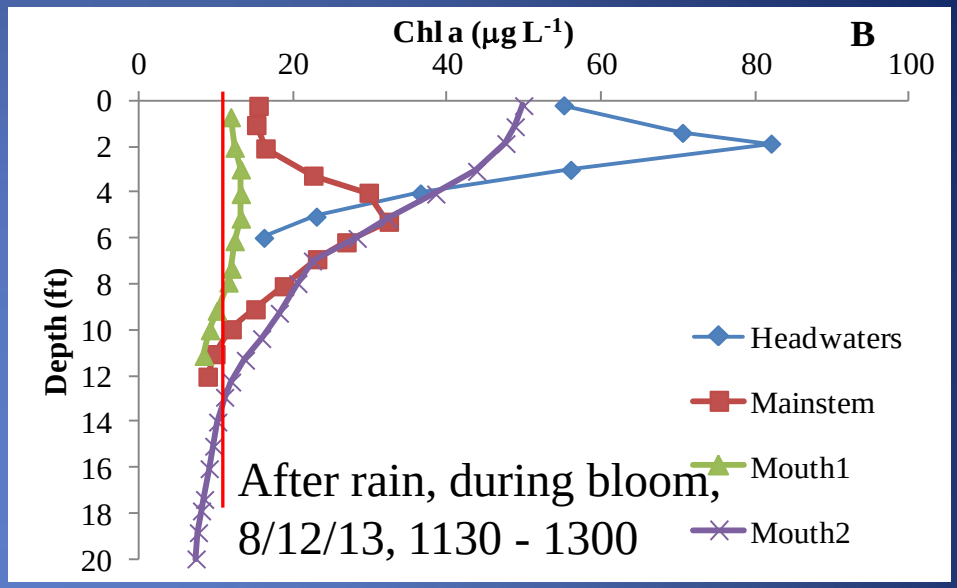
After storm 6/8/13 (1720 – 1845) – stratified water column, particularly in headwaters and mainstem

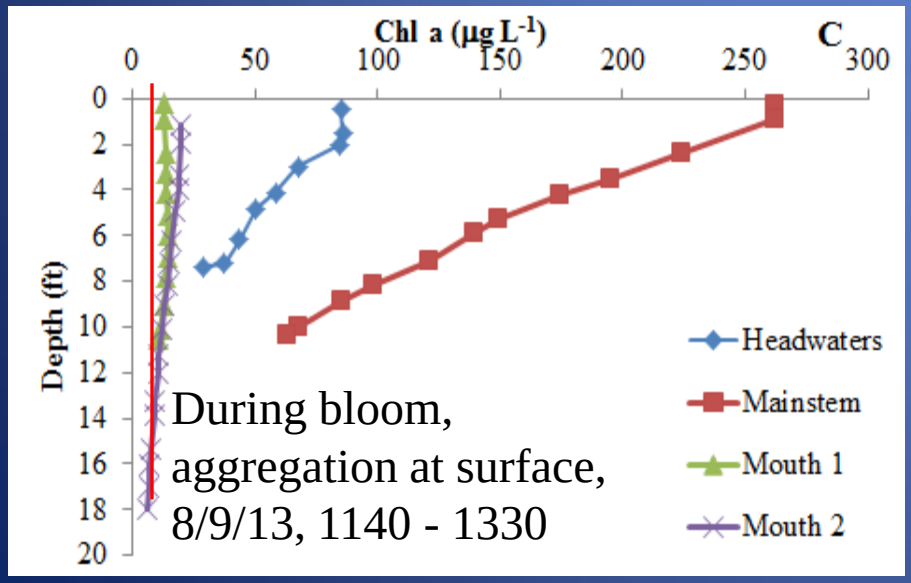


* Interpretation could also be skewed since profiles were taken at mid-day and early evening

Vertical profiles – Chl *a* variability

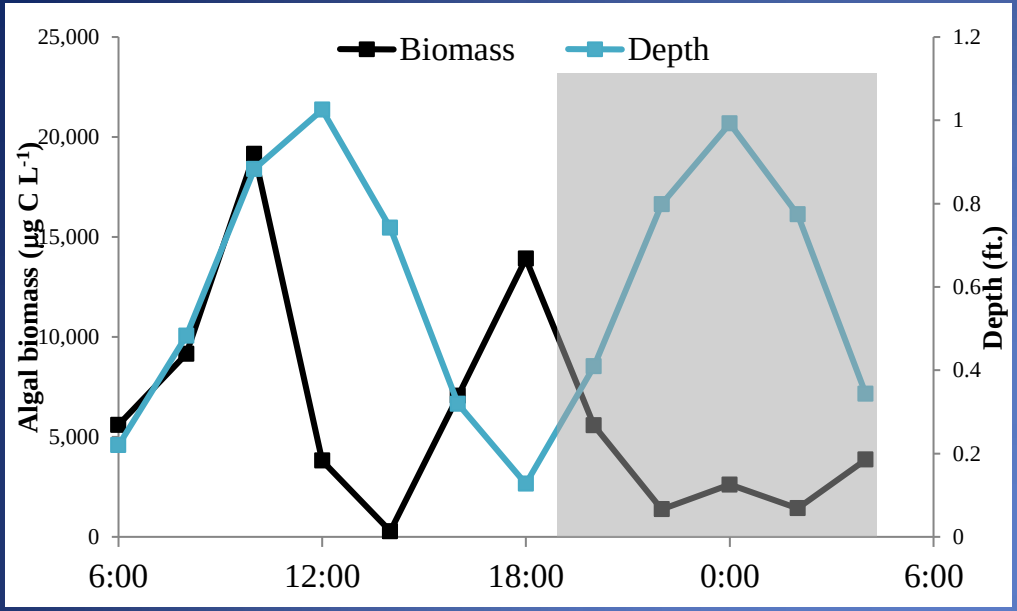


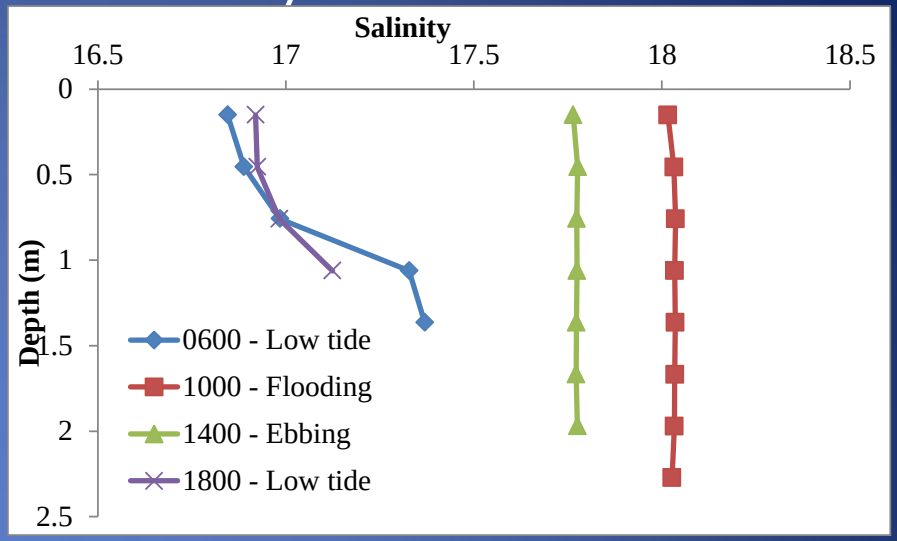


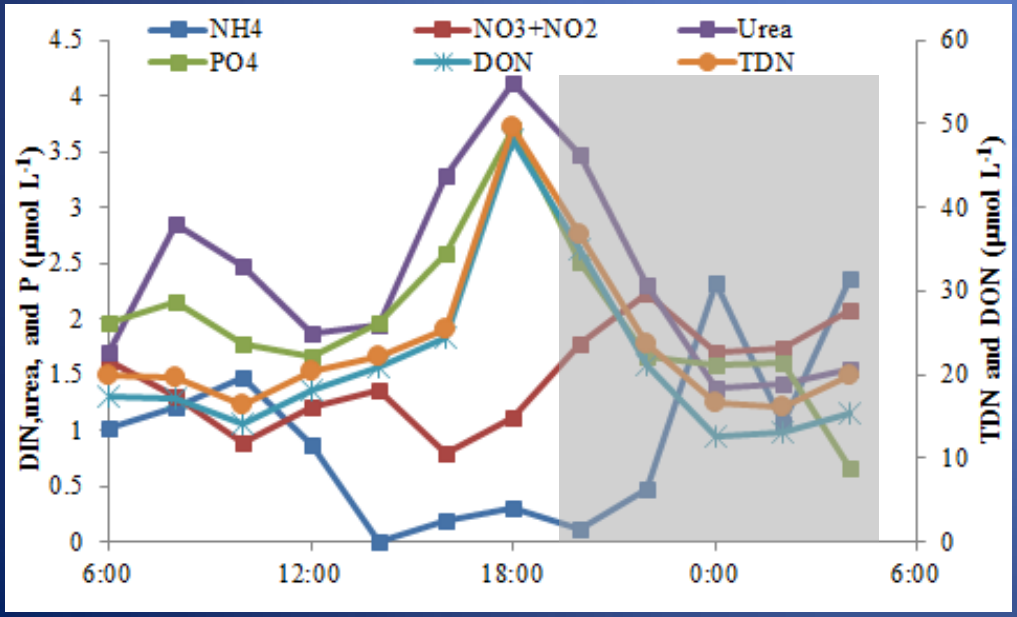


- Of the total vertical profiles conducted in 2013 during nutrient pulse cruises, 73% had chl *a* maximums either at the surface (< 0.5 m) or sub-surface (0.5 – 1.0 m) layers
- Temporal (diel variability, timing between storm events) and spatial (mouth vs headwaters) variability important
- Indicates a strong need to assess chl *a* with depth in order to gain a representative estimate of its related effects on designated uses.

Diel variability





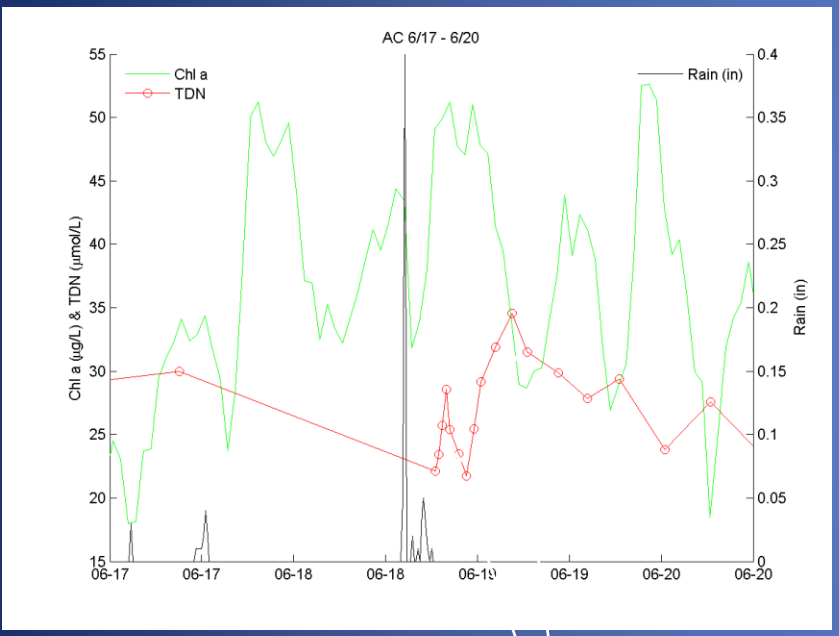


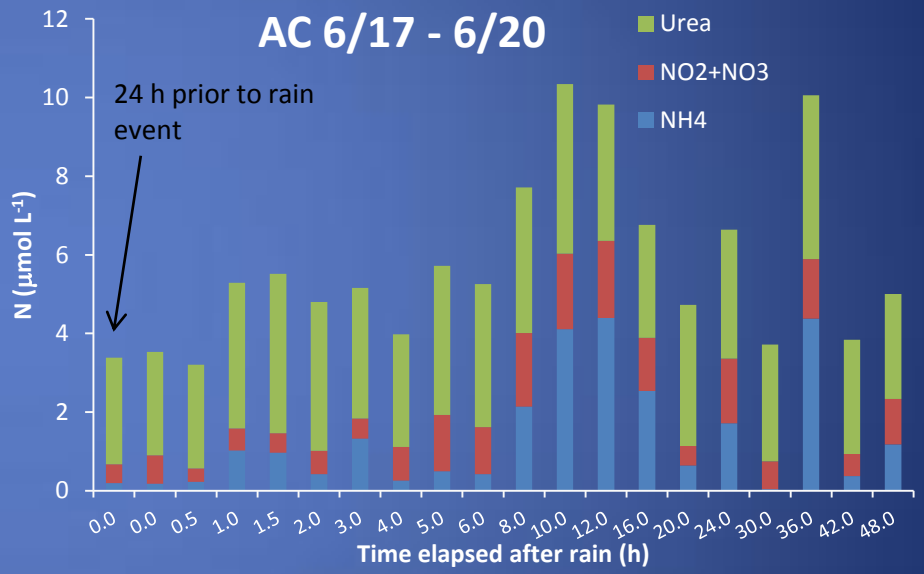
- Chl *a* and biomass data convoluted with tide, stratification, light, and vertical migration
- Stratified water column at low tide – surface chl *a* higher in evening compared to morning
- Mixed water column at flood and ebb tides – surface chl *a* higher in mid-morning compared to evening
- Bulk N (TDN & DON) trends with tide
- DIN trends with biomass

Analyses to date: Rainfall – nutrient – chl *a* relationship

- Wind and rain events likely add nutrients and stimulates Chl production
- Although nutrients can be modulated by tide, only bulk nitrogen (TDN & DON) and P have significant relationship with depth
- DIN concentrations and affects on Chl a are regulated by biology and introduction of nutrients through rain, run-off, and mixing. BUT effects confounded by diel light cycle and tidal mixing/forcing. Timing may be important

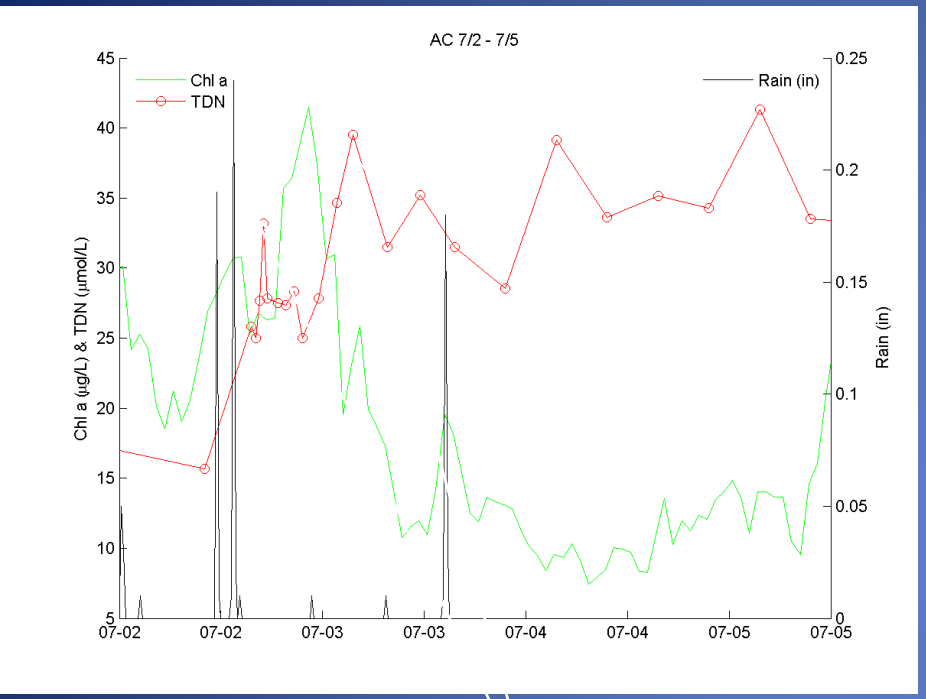
AC-Rain events 2013

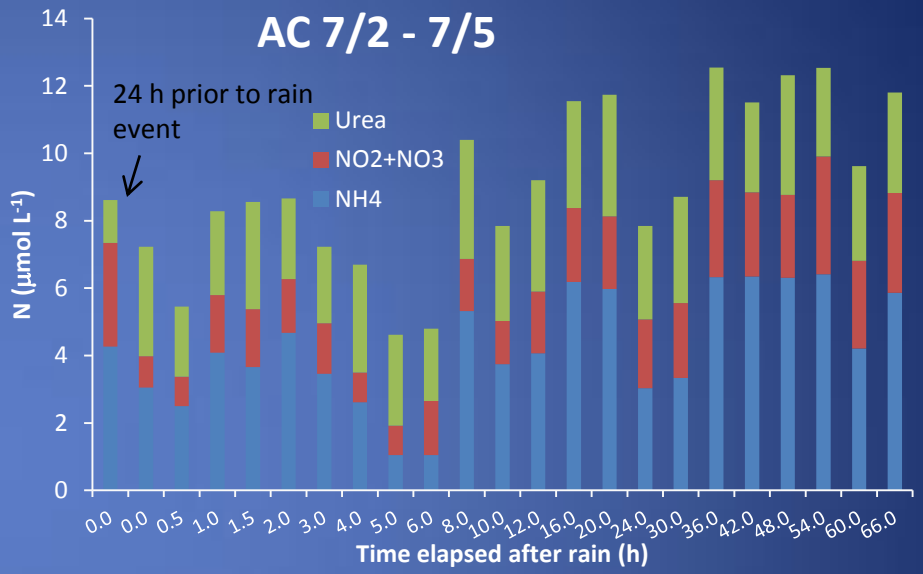




- Small rain event < 0.5 in.
- TDN peaks at 1.5 h and 10 h after rain event
- No major change in Chl a, fluctuates with tide
- N pool dominated by urea and NH_4^+

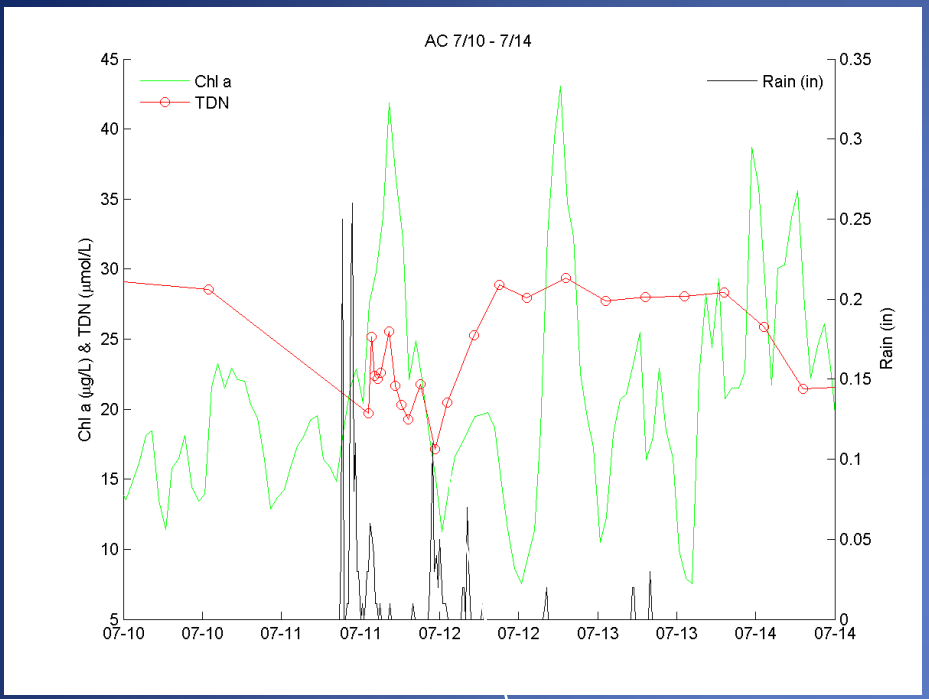
AC-Rain events 2013

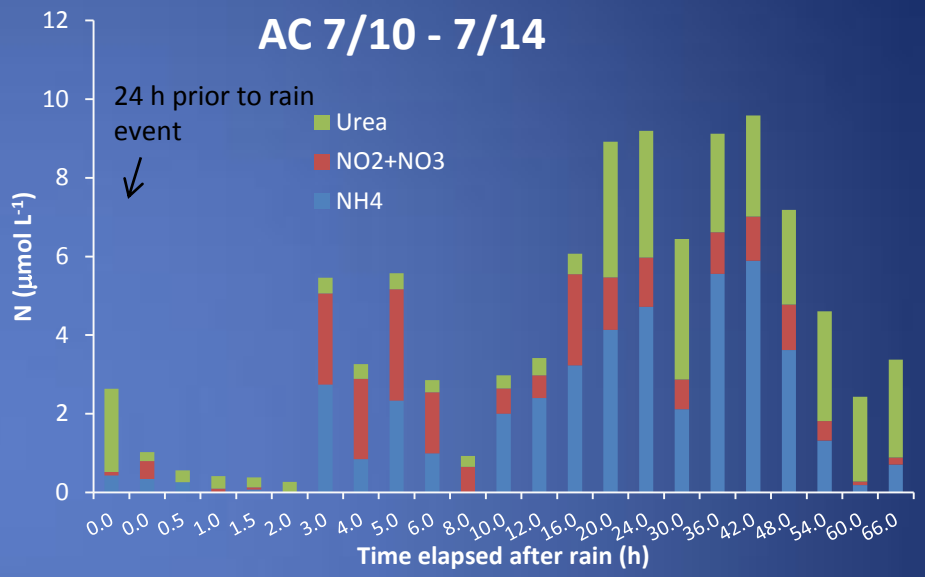




- Medium rain event > 0.8 in.
- TDN peaks at 1.5 h and 12 h after rain event, then levels out
- High Chl a after rain event, coinciding with TDN decrease (6 h), then sharp decline as TDN stays elevated
- N pool dominated by NH_4^+ and urea, also see decrease with Chl a increase at 6 h

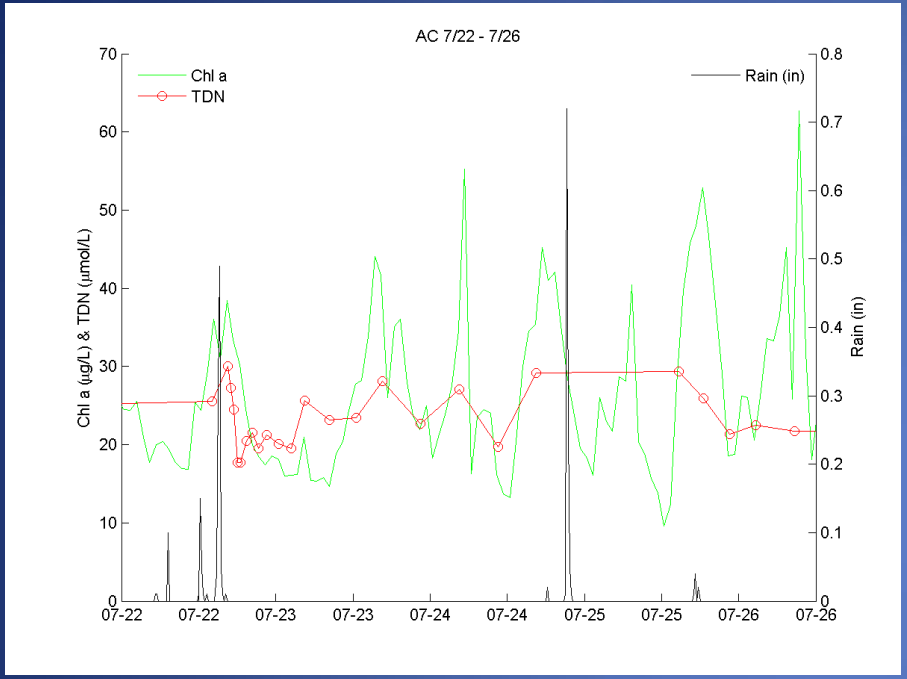
AC-Rain events 2013

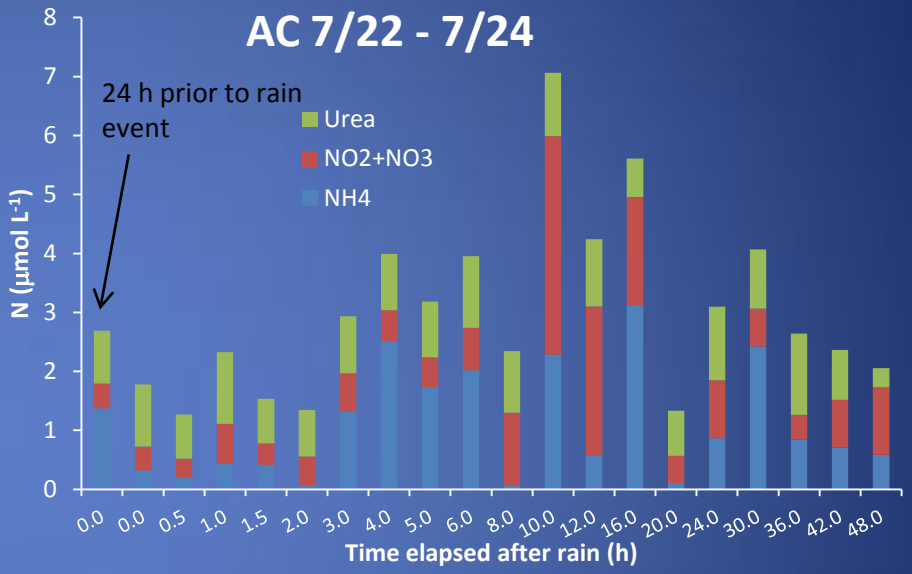




- Large rain event > 1.3 in. in 6 hours
- TDN lowest at 10 h then levels out
- High Chl a after first and second rain event
- Inorganic N and urea depleted in first 3 hours during initial Chl a increase, NH_4^+ and urea increase (recycled)

AC-Rain events 2013





- Large rain event > 1 in. in 6 hours
- TDN lowest at 1.5 h then levels out
- Chl a trends with TDN
- N pool dominated by NH_4^+

* Take home message, all rain events not created equal

Analyses to date: Rainfall – nutrient – chl *a* relationship

- 2012 & 2013 – Strong relationship between chl *a* & temp.
- Rain event frequency & duration appear to initiate blooms once temps. are greater than 24°C
- 2012 – Whole river and CONMON sampling, captured large-scale nutrient concentrations, but difficult to relate to precipitation events
- 2013 – Effects of rainfall on in situ nutrient concentrations and chl *a* are highly variable because of interactive effects between magnitude of inputs, tidal forcing, and biology

Analyses to date: Data gaps

- *2014 – Relate diel changes in the vertical distribution of chl* a *to surface chl* a *concentrations made – Diel variability can be greater than seasonal and/or annual variability*
  - *Attainable criteria during what part of the solar or tidal cycle? At what depth?*
- *2014 – Direct assessment of atmospheric deposition (wet only) component not yet quantified; sediment advective flux in response to wind*